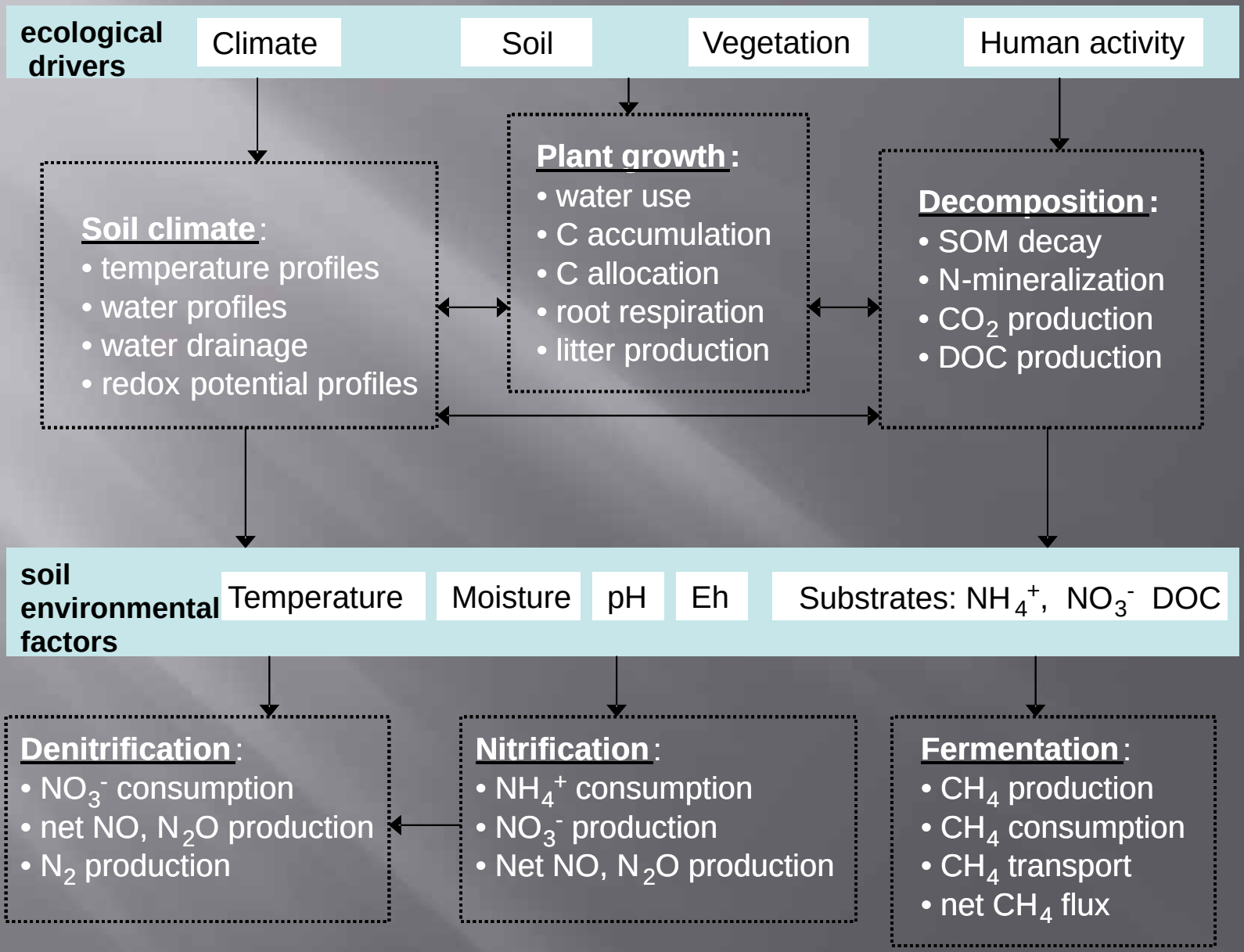
GHG Emissions Reductions Practices on Rice Farms in the Sacramento Valley: Accounting for Multiple Benefits for Producers and the Environment

- Funding: NRCS CIG Program, 2 year project
- Objectives:
  1. To develop, refine, and test GHG emission reduction practices on rice farms in the Sacramento Valley,
  2. To assess their economic and operational feasibility, and
  3. To test GHG accounting protocols all in an effort to facilitate agriculture sector participation in potential future GHG emission reduction programs.
- Team: Environmental Defense Fund, California Rice Commission, and Applied Geosolutions, LLC.

Approach

- Identify and describe practices to reduce GHG emissions from rice production.
  - Water management: Flooding duration, use of winter flooding
  - Rice straw management: Removal versus incorporation
  - Fertilizer use (split applications)
- Use DNDC Model to assess net impacts of various management practices on GHG, soil carbon, water use and rice yields.
- Develop protocols for accounting for changes in GHG emissions.
- Assess economic and operational feasibility of adopting voluntary GHG reduction measures.

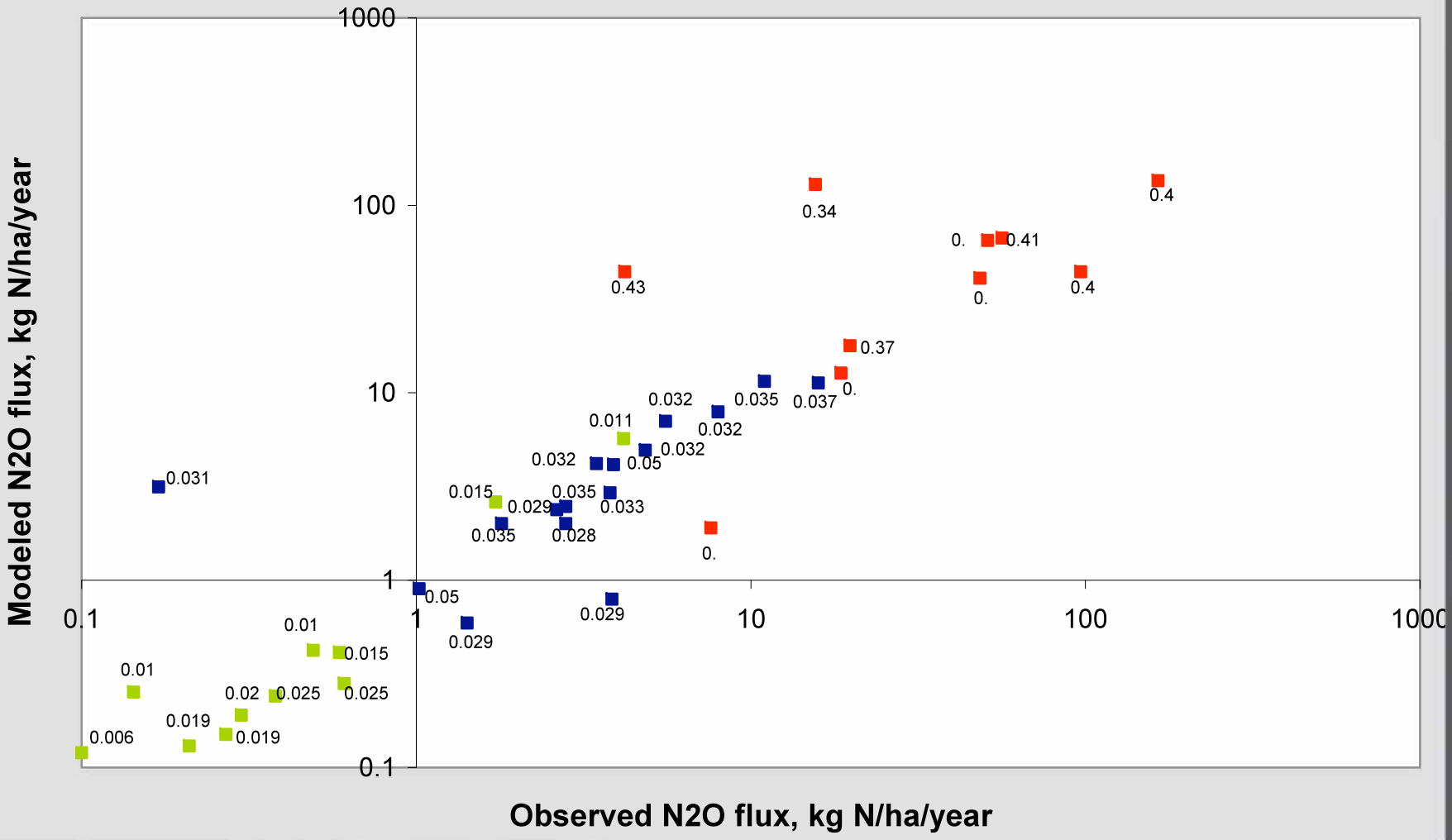
The DNDC Model



Model Validation…

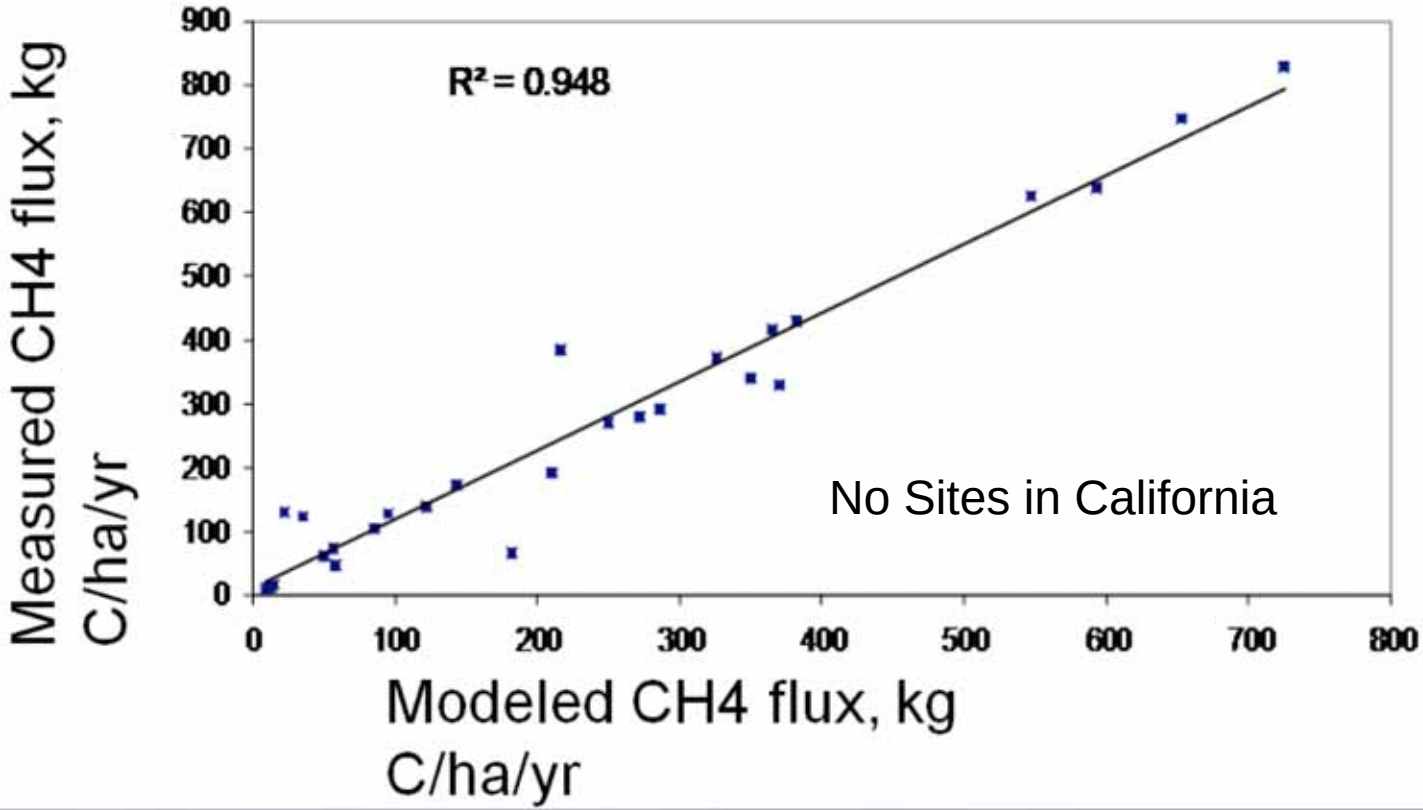
- Rigorous model validation is key for acceptance (scientific and market)
- Lack of appropriate field data for process-model validation
- DNDC has been validated extensively for agroecosystems worldwide (over 100 peer review papers)
- Additional validation efforts underway (e.g. CA).

Observed and DNDC-Modeled N2O Fluxes from Agricultural Soils in the U.S., Canada, the U.K., Germany, New Zealand, China, Japan, and Costa Rica



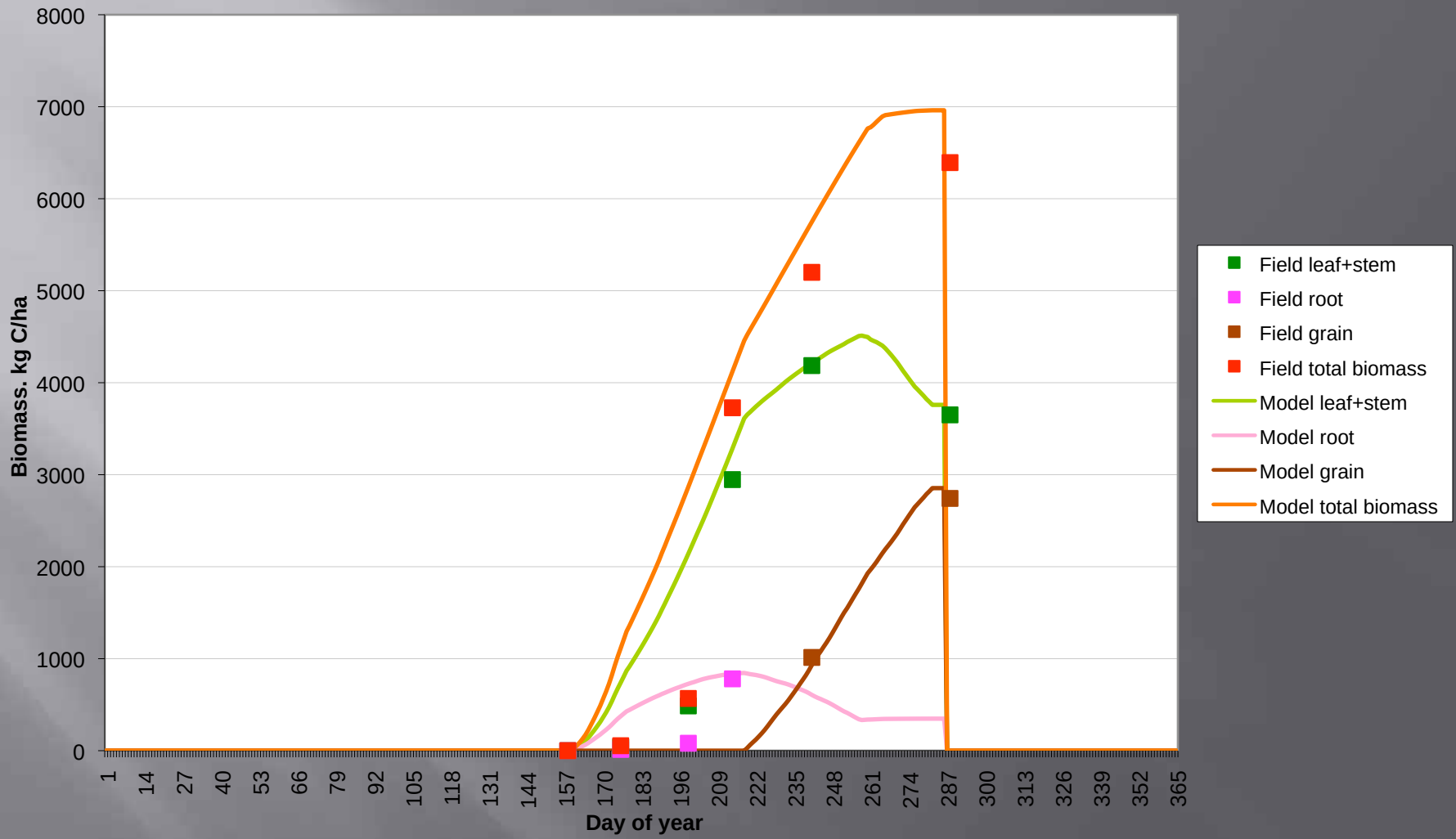
Model Validation: Rice

Observed and DNDC-modeled CH4 fluxes from rice paddies in China, Thailand, Japan, Italy and the U.S.

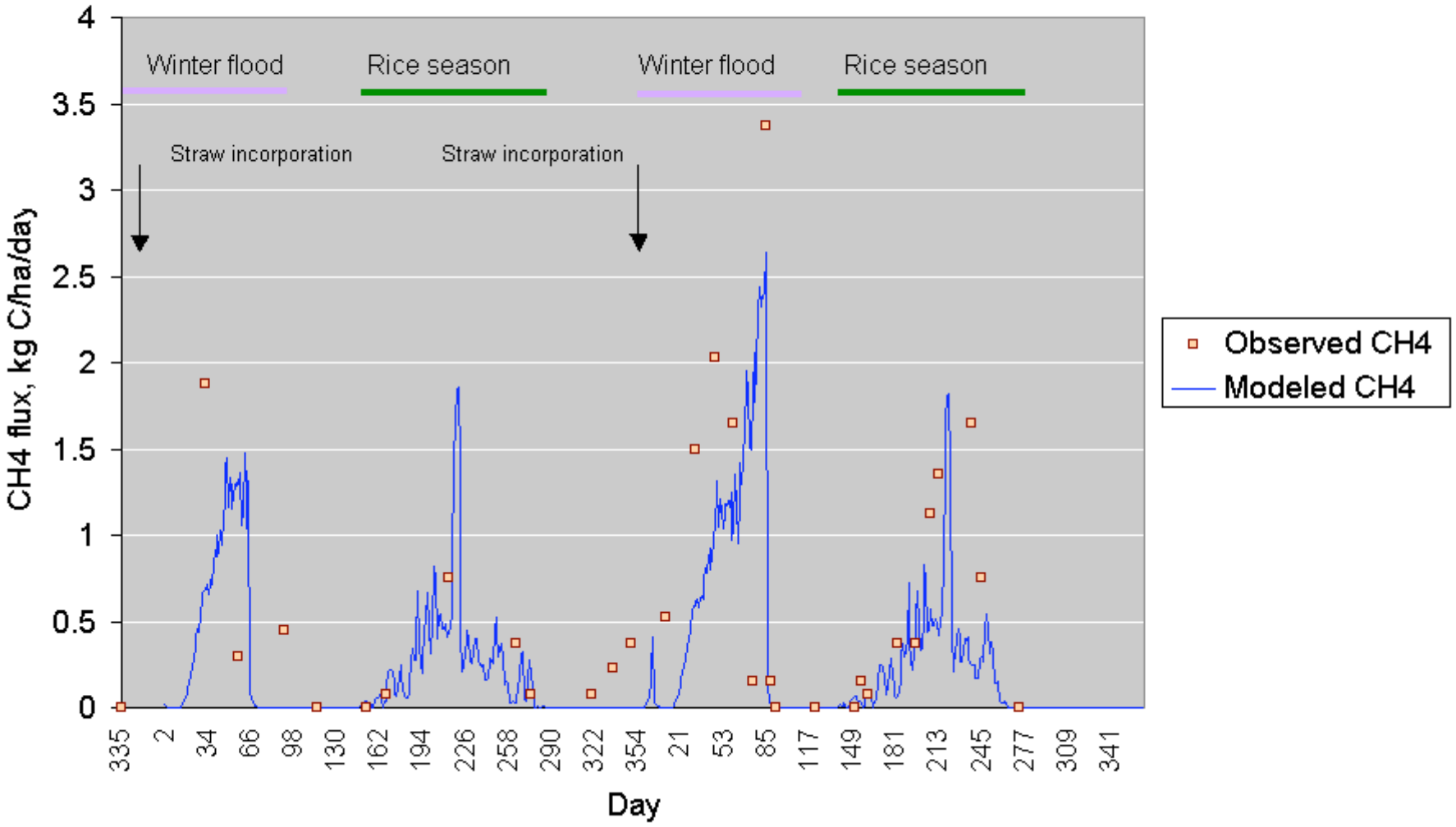


No Sites in California

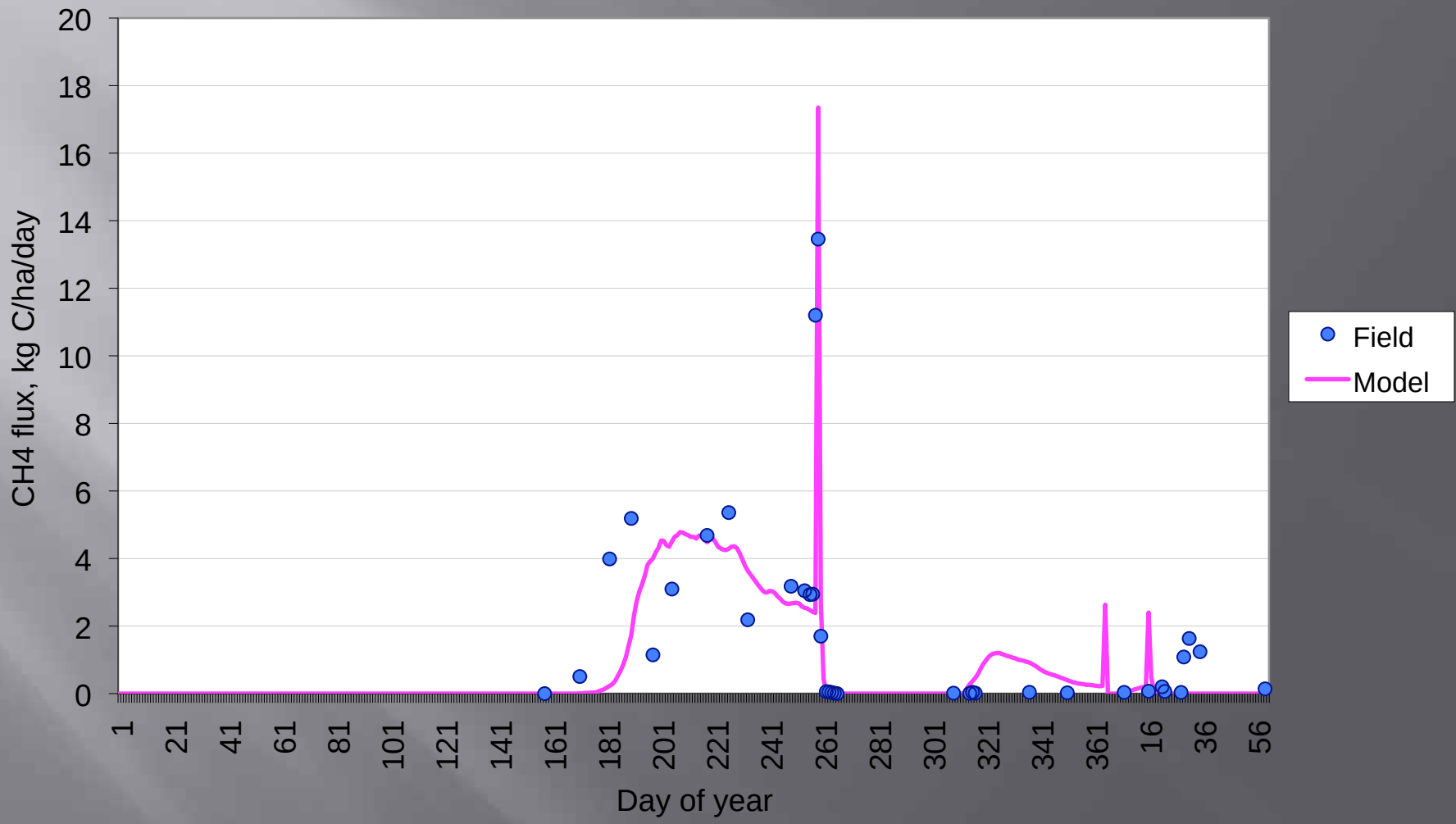
Observed and modeled crop biomass for a paddy rice field with treatment WS Con in RES, California in 2008



Observed and DNDC-modeled methane fluxes from a paddy rice field with winter flood and straw incorporation in Maxwell, California 1994-1996



Observed and modeled methane fluxes from a paddy rice field with treatment WS Con in RES, California in 2008-2009



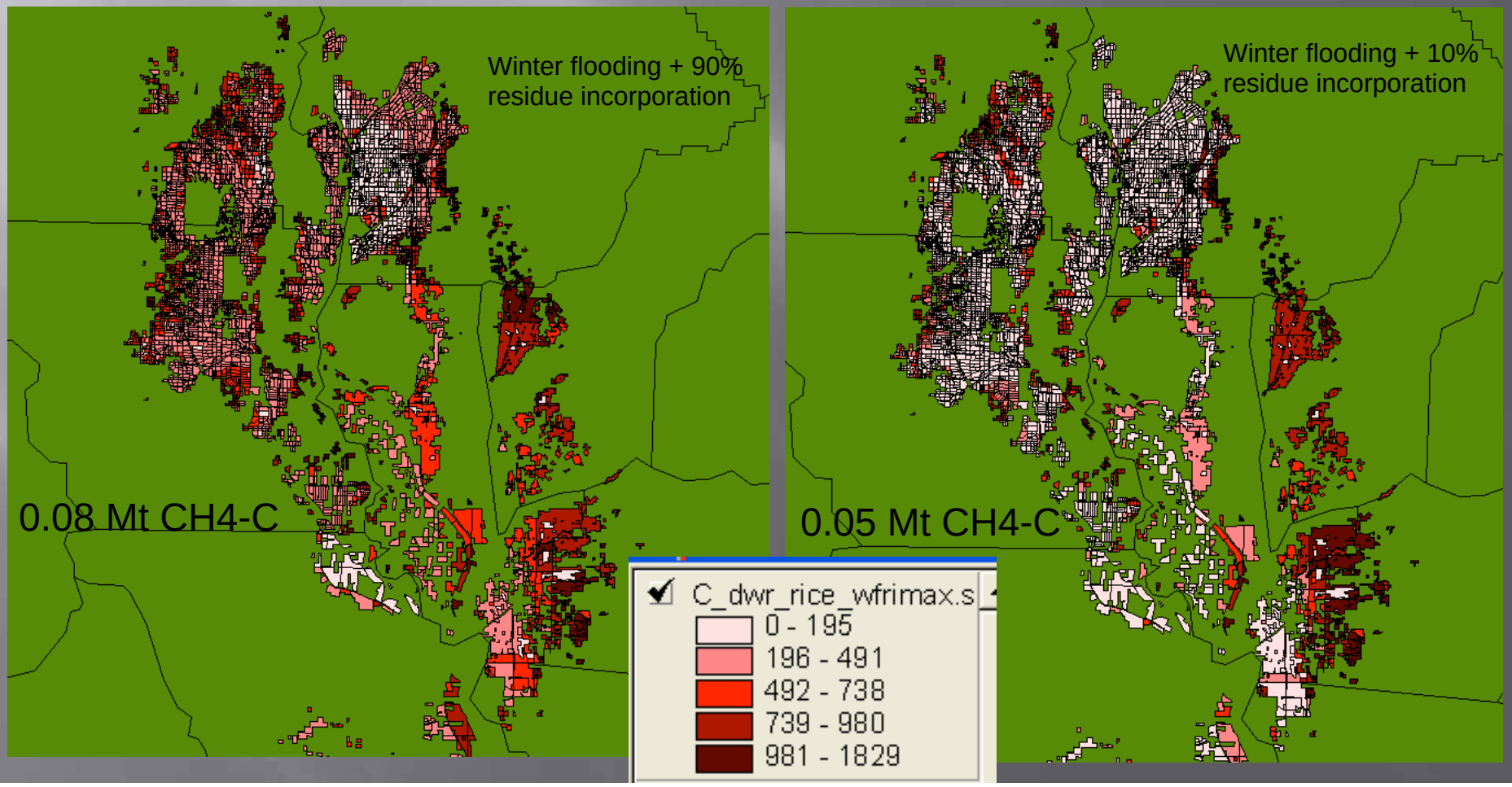
Initial Results:

- DNDC model validation based on Fitzgerald et al. study indicates the model can capture variability of methane emissions across rice water and straw management regimes.
- Baseline (typical current management practices)
  - Rice straw incorporation following harvest.
  - Winter flooding for enhanced rice straw decomposition
- Alternative Management Scenarios:
  1. Removal of 90% of rice straw following harvest with winter flooding.
  2. Rice straw incorporation without winter flooding.
- Potential Offset by Scenario 1 = 0.03 MT CH4-C (0.85 MT $CO2_{eq}$)
  - Approximately a 35% reduction in methane emissions by removing rice straw prior to winter flooding.
- Further Model validation is underway to improve our

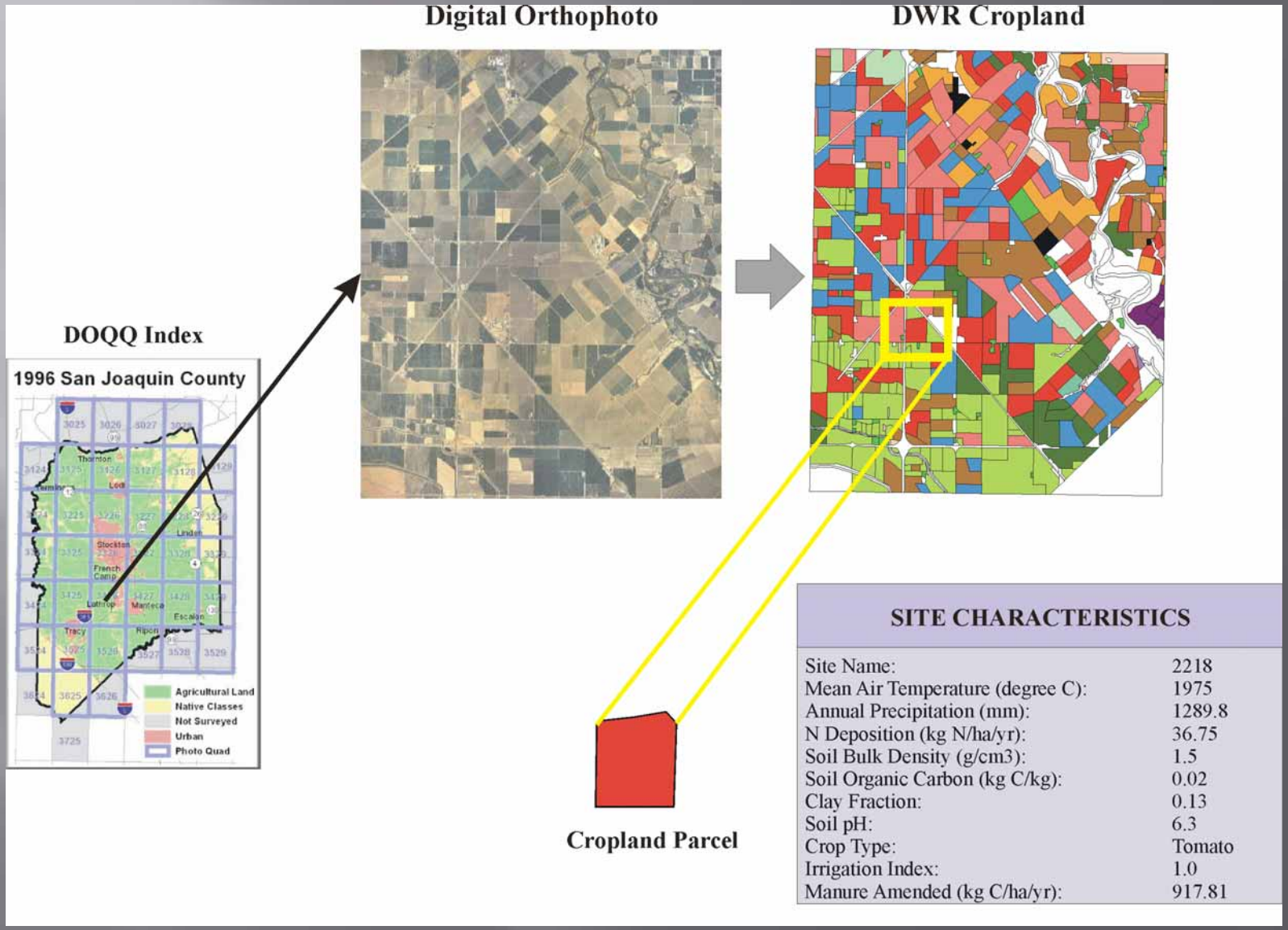
Preliminary Results:

Spatially explicit DNDC-modeled CH4 emissions from CA rice fields with different water/residue management practices in 2004

- **Baseline emissions (0.08 MT CH4-C)**
- **Straw removal emissions (0.05 MT CH4-C)**

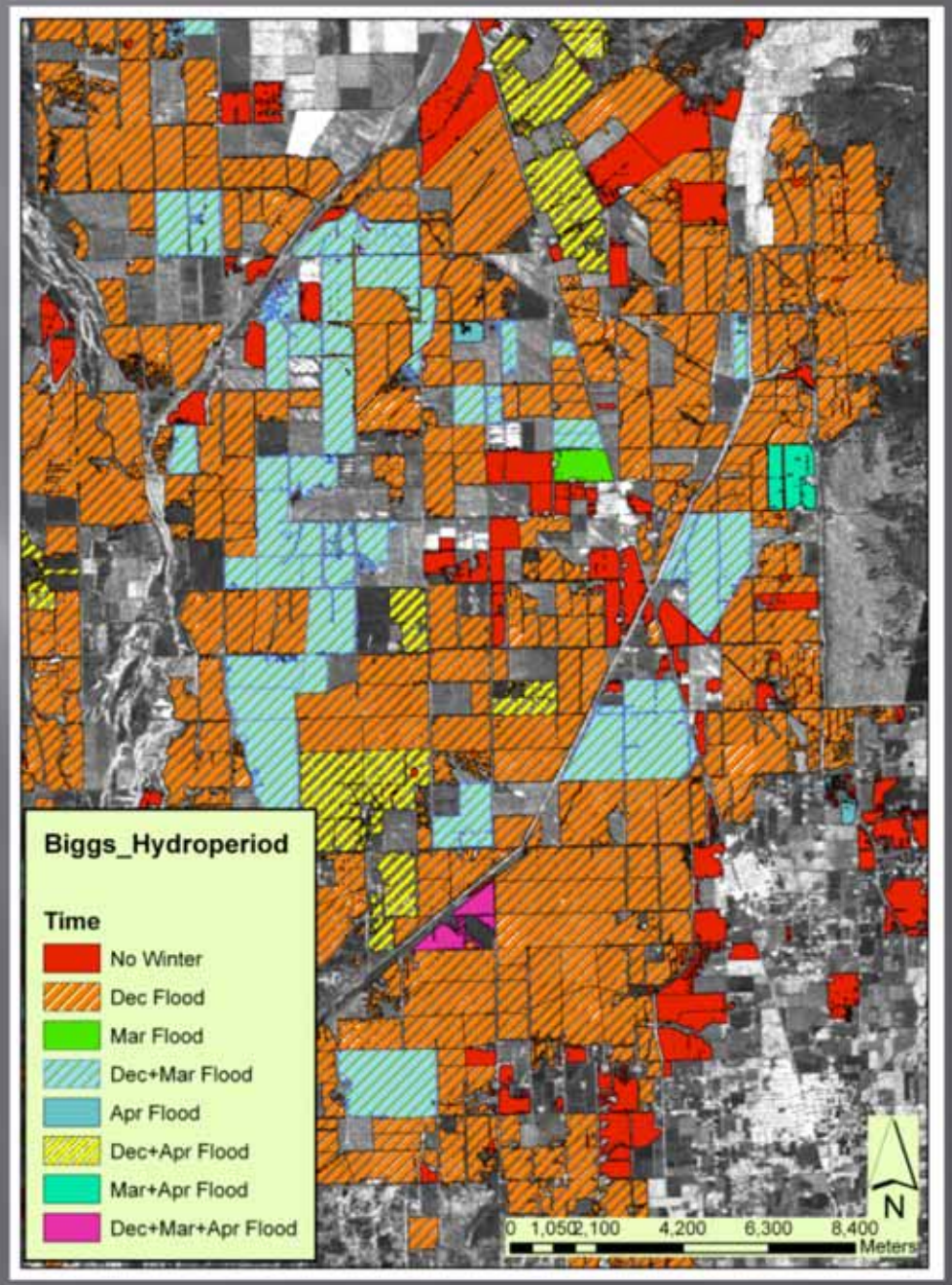


Next Steps: Web Version



Rice Acreage and Winter Flooding Regimes

- Used Remote Sensing (PALSAR) to map rice extent and water management –indentify baseline management.
- ~235,000 ha of rice
- Mapped duration of winter flooded



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